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ABSTRACT

The prediction that differences in incomes of high school and college graduates will not change is tested by applying standard statistical procedures to data describing actual income differences. Data from the United States Bureau of the Census describe annual incomes of men twenty-five years old and older during 1956-75. Report 1 displays results of using a standard multiple regression program to study these data on the assumption that differences in incomes of high school and college graduates one year predict future income differences. Results by adding the variable, gross national product in the year prior, appear in Report 2. Report 3 summarizes analyses incorporating the variable of starting salaries of college graduates. Reports 4-6 and appended Reports A1-A22 display results of analyses including other variables. A few brief summary statements are made. Two theories are discussed: (1) marginal productivity theory of wages, which posits entry into the world of work with a set of abilities to compete for jobs and wages on the basis of productivity and (2) job competition theory of wages that rests on the propensity of employers to reduce labor training costs by hiring the best educated people available at prevailing rates of pay. (YLB)

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THE CONTINUING SEARCH FOR BETTER PREDICTORS OF INCOMES OF HIGH SCHOOL AND COLLEGE GRADUATES*

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Each year millions of high school graduates evaluate programs of study and institutions of higher education, forego substantial current income, and spend millions of dollars to meet tuition and other costs of investing in college and university education. Taxpayers, legislators, governors, members of governing boards, administrators, faculties, alumni, philanthropists, accrediting agents, and many others also evaluate programs and institutions as they make decisions concerning where and how to invest funds, time, and effort. Students and others invest in higher education programs of study and instruction, in part, because they note the high values society places on the products and services of college and university graduates - - values evidenced by relatively high salaries and wages.

Evaluations of programs of study and instruction will become more accurate, and therefore more useful, as increasingly objective methods are developed and applied. The greatest potential for improvement in evaluation seems to lie in rate of return studies which relate the cost of investments to the value of benefits. Benefits are evidenced by the differences between the lifetime incomes of college graduates and those of high school graduates of equal academic aptitude who do not pursue college education. Accurate cost estimates are not difficult to make; the making of accurate predictions of incomes, and income differences, however, is difficult. Indeed, the pioneers in the field - - Walsh, Schultz, and Becker - - implicitely predicted that incomes in the future would be the same as incomes today.

In 1959, Houthakker departed from that tradition and increased the accuracy of income predictions by incorporating factors describing the growth in the economy.

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Since that time, Freeman, Smith, Welch, Witmer, and others have suggested other factors that increase the accuracy of predictions of income, but add little to the underlying, explanatory theory.

The prediction that differences in incomes will not change, i.e., that the income differences in a given year are good indicators of income differences in the next year, and in the next year, etc., is basic to the work of Walsh of Harvard, published in 1935. The accuracy of this prediction can be tested by applying standard statistical procedures to data describing actual income differences. Data describing the annual incomes of men 25 years old and older during the period 1956-75 are available from the U. S. Bureau of the Census (1966).

The results of using a standard multiple regression program to study this data describing the income experiences (in 1977 dollars, to offset consumer price inflation) of men 25 years old and older on the assumption that the differences in incomes of high school and college graduates one year predict income difference in the following year and in years following are displayed in REPORT 1. While having such data is infinitely better than having no data at all, our predictions of longitudinal incomes on the basis of cross sectional data are not very accurate.

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REPORT 1

Prediction of Income Differences
Between Male High School and College Graduates
25 Years Old and Older 1956-75

Coefficient of determination (R^2) .5797

Constant term 2699.3672
Standard error of estimate 481.1229

Variable	Regression coefficient (B)	Standard error	Computer t value	Beta
Income differences 1 year prior.	.6459	.1295	4.9859	.7616

Source of variation	Degrees of freedom	Sum of Squares	Mean squares
Attributable to equation	1	57454400.0000	5754400.0000
Deviation from equation (Residual)	18	4166626.0000	231479.2188

The significance level of the F ratio, which is 24.86, lies between .0005 and .0000.

In 1959 Houthakker increased the accuracy of income predictions by incorporating factors describing the growth of the economy. Adding this measure - - gross national product in the year prior - - to the equation predicting the income differences between male high school and college graduates 25 years old and older during the period 1956 through 1975 yields the much improved results displayed in REPORT 2.

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REPORT 2

Prediction of Income Differences
Between Male High School and College Graduates
25 Years Old and Older 1956-75

Coefficient of determination (R^2) .7667

Constant term 626.3516
Standard error of estimate 368.9951

Variables	Regression coefficient (B)	Std. error of reg. coef.	Computed t value	Beta
Income differences 1 year prior .	1:0456	.1791	5.8389	.7238
Gross National Product 1 year prior.	.1880	.0298	6.3177	.7831

Source of variation	Degrees of Freedom	Sum of squares	Mean squares
Attributable to regression	2	7606351.0000	3803175.5000
Deviation from regression (Residual)	17	2314675.0000	136057.3438

The significance level of the F ratio, which is 27.93, lies between .0005 and .0000.

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In 1976 Freeman published the following three-equation recursive adjustment model which seemed to hold promise for improving the accuracy of predictions of income differences despite the sensitivities and possible estimation errors associated with the high levels of auto correlation and colinearity in these data (Smith and Welch):

"FRSH = -2.02 + .88 POP + 1.31 [CSAL-ASAL] + .21 FRSH [-1]
(.21) (.26) [.16]
Coefficient of determination = .987
Standard error of estimate = .049
Durbin-Watson d = 1.79

"BA = -.63 + .71 FRSH [-4] + .29 FRSH [-5]
(.20) (.20)
Coefficient of determination = .976
Standard error of estimate = .061
Durbin-Watson d = 0.55

"CSAL = -2.52 - .15 BA(-1) + 1.1 DEM + .31 ASAL + .45 CSAL(-1)
(.02) (.51) (.24) (.11)
Coefficient of determination = .994
Standard error of estimate = .018
Durbin-Watson d = 1.51

"FRSH = number of first-degree, credit enrolled males

"CSAL = a weighted average of college starting salaries (in constant dollars) taken from the annual survey of F. Endicott, "Trends in Employment of College and University Graduates in Business and Industry," (Placement Center, Northwestern University). The weights are .05 for accounting, .35 for engineering, .20 for general business trainees, and .40 for sales.

"ASAL = average annual earnings (in constant dollars)

"BA = number of male bachelor's graduates.

"DEM = index of demand for college graduates, calculated by taking a fixed-weight index of employment in 46 industries."

Unfortunately, analyses summarized in REPORT 3 indicate that the starting salaries of college graduates represented by CSAL are not good correlates of income differences between male high school and college graduates 25 years old and older during the period 1956-75. In five tests of Freeman's formula FRSH = a+b, POP & b_2 (CSAL-ASAL) + b_3 FRSH $(-1)^b$ Wish and Hamilton found b_2 (CSAL-ASAL) the least important predictor of FRSH thus further reducing the promise of Freeman's work.

REPORT 3

Prediction of Income Differences
Between Male High School and College Graduates
25 Years Old and Older 1956-75

Coefficient of determination (R^2) .3965

Constant term 3196.4385
Standard error of estimate 576.7010

Variables	Regression Coefficient (B)	Std. error of reg. coef.	Computed t value	Beta
CSAL	.0403	.0117	3.4395	.6297

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	1	3934512.0000	3934512.0000
Deviation from regression (Residual)	18	5986514.0000	332584.1250

The significance level of the F ratio, which is 11.83, lies between .0050 and .0000.

Searching for more accurate predictors of income differences, I identified four independent variables which taken together yield the results displayed in REPORT 4, which I presented during Session 13G at the 1979 Forum of the Association for Institutional Research in San Diego, California, on 17 May. Ensuing communications and reports from institutional researchers, Smith and Welch, and Freeman (1979) stimulated a continuing search which yielded the results displayed in REPORT 5, REPORT 6, and the APPENDIX.

REPORT 4

Prediction of Income Differences
Between Male High School and College Graduates
25 Years Old and Older 1956-75

Coefficient of determination (R^2) .8116

Constant term 13925.8457
Standard error of estimate 353.0499

Variables	Regression Coefficient (B)	Std. error of reg. coef.	Computed t value	Beta
Male population 22 years old, 13 years prior.	-6.1292	2.2641	-2.7072	-.5486
Male college graduates at the B.A. and first professional degree level/male population 29 years old, 11 years prior.	.0408	.0163	2.5038	.3447
Male college graduates at the B.A. and first professional degree level, 14 years prior.	-.0176	.0119	-1.4802	-2.0070
Male college graduates at the B.A. and first professional degree levels/male population 29 years old, 14 years prior.	.1748	.1357	1.2879	1.8349

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	4	8051364.0000	2012841.0000
Deviation from regression (Residual)	15	1869663.0000	124644.2031

The significance level of the F ratio, which is 16.15, lies between .0005 and .0000.

REPORT 5

Prediction of Mean Income , in 1977 dollars,
of Male High School Graduates
25 Years Old and Older, Who Had Income , 1956-77

Coefficient of determination (R^2)	.98031
Adjusted R^2	.97567
Constant term	10017.65
Standard error of estimate	203.04772

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
High school graduates, in thousands, 31 years prior.	5.609372	.20308	762.953	1.03672
Personal income, in hundreds of millions of 1977 dollars, 42 years prior.	-.3019670	.13774	4.806	-.08321
Expenditures for higher education as a share of GNP in tenths of percents, 22 yrs. prior.	-63.01759	30.45589	4.281	-.07564
Personal income, in hundreds of millions of 1977 dollars, 41 years prior.	-.2802451	.13843	4.099	-.07552

Source of variation	Degrees of freedom	Sum of Squares	Mean Squares
Attributable to regression	4	34887430.34246	8721857.58562
Deviation from regression (Residual)	17	700882.43026	41228.37825

The significance level of the F ratio, which is 211.54986, lies between .0005 and .0000.

Durbin-Watson d = 2.19533

REPORT 6

Prediction of Mean Income , in 1977 dollars, of
Male College Graduates
25 Years Old and Older, Who Had Income , 1956-77

Coefficient of determination (R^2)	.96537
Adjusted R^2	.95722
Constant term	13975.01
Standard error of estimate	379.12658

Variables	Regression Coefficient (B)	Std. error of reg. coef.	Computed F value	Beta
High school graduates, in thousands, 31 years prior.	7.578730	.38842	380.711	.99475
Labor force unemployed, in tenths of per cents, 42 years prior.	-4.570381	1.38834	10.837	-.18914
Labor force unemployed, in tenths of per cents, 45 years prior.	6.404756	1.78038	12.941	.18112
Labor force unemployed, in tenths of per cents, 16 years prior.	-5.776434	3.20018	3.258	-.09083

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	4	68117550.76954	17029387.69239
Deviation from regression (Residual)	17	2443528.32136	143736.96008

The significance level of the F ratio, which is 118.47605, lies between .0005 and .0000.

Durbin-Watson d = 2.33671

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The following variables were rejected in the studies reported in REPORTS 5, 6, and A1 through A22 because they added less to the prediction than did other variables, were excessively collinear, and/or were not sufficiently significant:

Gross National Product of the United States in hundreds of millions of 1977 dollars, 9 and 10 years prior.

Personal income per capita in 1977 dollars, 9, 10, ...27 years prior.

Disposable income per capita, in 1977 dollars, 9, 10, ...27 years prior.

Average spendable weekly earnings of U.S. workers, in 1977 dollars, 9 years prior.

School enrollment rates of females, in tenths of percents, 9, 10, ...48 years prior.

School enrollment rates of males, in tenths of per cents, 9, 10, ...26, 28 ...48 years prior.

Retention rates: number of persons in grade 13 per 100 who entered grade 5, 9, 10, ...24 years prior.

Sibling overlap at college age, in hundreths (based on Golberg and Anderson) 9 years prior.

Average mental ability of college entrants in mean percentile ranks of entering freshmen (based on Taubman and Wales), 9, 10, ...48 years prior.

American College Test composite score, in tenths, 9 years prior.

Verbal Scholastic Aptitude Test score, 9 years prior.

Mathematics Scholastic Aptitude Test score, 9 years prior.

College grade point average on four point scale, in hundreths (based on Suslow).

United States population of 22 year old males, in thousands, 9, 10, ...17 years prior.

Higher education attainment rate: the number of persons earning bachelors and first professional degrees, divided by the number of 22 year old males, in ten thousands, 9, 10, ...17 years prior.

Freeman's CASL: a weighted average of college monthly starting salaries (in constant 1977 dollars and cents) (taken from the annual survey of Endicott) (the weights are .05 for accounting, .35 for engineering, .20 for general business trainees, and .40 for sales), 9 years prior.

To avoid recursiveness, i.e., prediction based on previous prediction based on previous prediction ..., the following data limits were used in the studies reported in REPORTS 5, 6, and 1A through 22A:

Salary at Age	Most Recent Year Prior	Earliest Year Prior
25 and older	9	48
29	9	48
39	17	48
49	26	48
59	35	48
69	43	48

In studies of male salaries the number of cases was 22 and the maximum number of independent variables in a single predicting equation was limited to 4. In studies of female salaries the number of cases was 11 and the maximum number of independent variables in a single predicting equation was limited to two. In all studies the colinearity tolerance was preset at .80 while the test of significance was reported as a computed F value and the test of auto-correlation was reported as a computed Durbin-Watson d statistic.

Scholars who usually deal with nonexperimental matters are tempted to say, "Don't trust an observation unless it is confirmed by a good theory and don't trust a multiple regression study unless the results confirm a priori beliefs, i.e., those held independent of observation!" Yielding to such temptation nulifies

empiricism - - the induction of knowledge from observation and experience - - and leaves us with rationalism - - the deduction of knowledge from a priori presumptions based on received authority and revelation, i.e., if what we see does not fit our presumptions, we reject what we see! Resisting such temptation facilitates the finding of better predictors.

The purpose of these studies was prediction, not the testing of hypotheses, nor the development, explanation, and elucidation of theory. Nonetheless, a few brief summary statements do not seem inappropriate.

> In making predictions of income, data describing conditions 48 to 39 years prior are about as useful as data describing conditions 38 to 26 years prior which are more than twice as useful as data describing conditions 25 to 9 years prior, e.g., data describing conditions from 9 to 25 years prior represent one-third of the 11,400 possibilities in the twenty-four studies but yield only one-eighth of the best predictors, one-seventh of all predictors, and one-seventh of a weighted sum of all predictors.

> The number of high school graduates is the most useful variable, particularly for predicting the incomes of men. The second best predictor is birth rate.

> Declining birth rates and declining numbers of high school graduates predict rising average incomes of male high school graduates ages 59 and 69, male college graduates age 49, and female college graduates age 25 and older. Total declining personal disposable income in the United States predicts rising average incomes of women college graduates age 59. In all of the other nineteen studies increasing birth rates, increasing numbers of high school and college graduates, and increasing size of labor force predict increasing average incomes of persons, male and female, high school and college graduates!*

> The economic measures of personal income and disposable personal income are the most useful predictors of the incomes of women college graduates while the size of the labor force and the number of baccalaureate and first professional degrees earned by men are outstandingly useful predictors of the incomes of women high school graduates who do not graduate from college.

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*This contrasts sharply with Welch's prediction that as age cohort sizes increase, wages will fall; and as age cohort sizes fall, wages will increase, and wages of new-entrant college graduates will rise relative to those of workers with less schooling.

Other economic and labor market variables such as gross national product per person, percent of the labor force unemployed, and professional workers as a share of the total labor force are also useful as are share of population living in urban households, household average size, and higher education income and expenditure statistics.

None of the measures of academic aptitude, mental ability, school enrollment rates, retention rates, and student performance* are useful in predicting incomes nor are sibling overlap statistics. Starting salaries of college graduates are not very useful predictors of salaries of men or women, high school or college graduates, at ages 25+, 29, 39, 49, 59, or 69!

These findings support positions taken by Adkins, Easterlin**, Hoyt, and Jencks and others emphasizing the importance of demographics, and long term socio-economic change while deprecating the significance of SAT scores and college student grades as portents of the value of college education. None of these scholars, nor anyone else, has yet developed comprehensive theory to unify all of these phenomena, however two limited theories are germane.

The marginal productivity theory of wages posits the entry of people into the world of work with a set of abilities to compete for jobs and wages on the basis of their productivity. Education is crucial in this competition because it creates abilities and increases people's potential to be productive. Moreover, the theory implies that increases in the educational level of low income workers will have three powerful and beneficial effects: First, education that transforms low ability persons into high ability persons raises their productivity and therefore raises their wages and incomes. Second, it reduces the total supply of low ability workers, a reduction that in turn leads to increases in their wages as fewer people are available to do the menial and distasteful work. Third, it creates an over-supply

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*D. E. Rice (Hollingworth, 1916), Gambrill (1922), and other uncounted researchers since have found a relationship between success in college and income later in life the existence of which these findings do not deny. Rather, this and related research (Witmer, 1971) is telling us that other matters, including major program of study, are more useful predictors of subsequent income levels than are measures of success in college.

**These studies do not, however, support the zero sum theory that members of very large age cohorts have lower average incomes than do members of very small age cohorts!

of high ability workers, and causes their wages to be bid down. The theoretical net result is an increase in total output because of the increase in productivity of better educated workers; a flow of rewards to the meritorious, and a more equal distribution of wages and incomes. What a bright prospect! Indeed, what in the political economy could be better?

The data in TABLE 7 describing the experiences of women in the short period 1967-78 are in consonance with the marginal productivity theory; those in TABLE 8 describing the observed experiences of men in the longer period 1956-78 are not! Reviewing the transition to universal secondary education which has been completed in the United States since World War II we note that: (a) the percentage of 18 year old men earning high school diplomas increased from 49 in 1947 to 74 in 1967 and has fluctuated between 73 and 76 percent each year since; (b) there is a high, positive correlation between the percentage of each cohort graduating from high school and the difference between incomes of elementary and high school graduates,

TABLE 7

Comparisons of Mean Incomes, in 1977 dollars, of Female High School and College Graduates 25 Years old or older.

Observed				Predicted			
Year (a)	High School (b)	College (c)	Ratio (c/b=d)	Year (e)	High School (f)	College (g)	Ratio (g/f=h)
1967	$ 5,656	$9,503	1.68				
1968	5,725	9,222	1.61				
1969	5,796	9,790	1.69	1979	5,721	9,471	1.66
1970	5,802	9,886	1.70	1980	5,715	9,267	1.62
1971	5,853	9,973	1.70	1981	5,449	8,896	1.63
1972	6,106	9,969	1.63	1982	5,333	8,610	1.61
1973	6,056	9,717	1.60	1983	5,204	8,561	1.65
1974	5,809	9,321	1.60	1984	5,097	8,270	1.62
1975	5,743	9,512	1.66	1985	4,903	7,713	1.57
1976	5,900	9,528	1.61	1986	4,675	6,706	1.43
1977	6,063	9,677	1.60	1987	4,502	6,139	1.36
1978	5,734	9,178	1.60	1988	4,380	6,093	1.39

(25 years old and older) ten years later; (c) from 1956 to 1978 the average constant dollar incomes of elementary and high school graduates increased substantially, presumably reflecting the increased productivity flowing from the increased education, but, (d) the distribution of incomes became more unequal as the incomes of male high school graduates increased from 143 percent of the incomes of male elementary school graduates in 1956 to 162 percent in 1978! This growing gap between the incomes of high school and elementary school graduates was apparent in 1970 when the prediction was made that the same thing would happen to the relationship between average high school and college incomes as the transition to universal higher education takes place and the college degree replaces the high school diploma as an entrance requirement for good employment (Witmer, 1970).

The transition to universal higher education is sufficiently advanced to yield observations that: (a) the percentage of each age cohort of men earning baccalaureate or first professional degrees increased from 12 in 1947 to 25 in 1967 and has fluctuated between 23 and 33 percent each year since; (b) there is a high, positive correlation between the percentage of each age cohort graduating from college and the difference between incomes of high school and college graduates (25 years old and older) ten years later; (c) from 1956 to 1978 the average constant dollar incomes of high school and college graduates increased substantially, but, (d) the distribution of incomes also became more unequal as the incomes of male college graduates increased from 152 percent of high school graduates in 1956 to 157 percent in 1978, according to the predictions in TABLE 8, will get even more unequal!

In 1975 Thurow described a job competition theory of wages to account for the stubborn and surprising fact that increased education yields increased inequality in incomes. His theory rests on the propensity of employers to reduce labor training costs by hiring the best educated persons available at prevailing rates of pay (equal to or below the value of marginal product) and to increase those rates of pay as the productivity of the firm (not the productivity of the individual person) increases.

TABLE 8

Comparison of Mean Incomes, in 1977 dollars, of Male High School and College Graduates 25 Years old or older.

Observed				Predicted			
Year (a)	High School (b)	College (c)	Ratio (c/b=d)	Year (e)	High School (f)	College (g)	Ratio (g/f=h)
1956	$11,434	$17,377	1.52				
1957	11,119	17,594	1.58				
1958	10,901	17,926	1.64				
1959	11,285	18,583	1.65	1979	$14,187	$23,401	1.65
1960	11,575	19,088	1.65	1980	14,143	23,150	1.64
1961	11,916	19,673	1.65	1981	13,979	23,105	1.65
1962	12,392	19,451	1.57	1982	13,691	23,091	1.69
1963	12,845	19,220	1.50	1983	13,276	23,592	1.78
1964	13,025	19,879	1.53	1984	13,049	24,028	1.84
1965	13,528	20,934	1.55	1985	12,878	24,292	1.89
1966	13,849	21,694	1.57	1986	13,026	24,495	1.88
1967	13,497	21,108	1.56	1987	13,373	24,572	1.84
1968	14,047	22,305	1.59	1988	13,584	24,554	1.81
1969	14,441	23,033	1.59	1989	13,935	25,004	1.79
1970	14,182	22,287	1.57	1990	14,595	26,021	1.78
1971	14,167	22,412	1.58	1991	16,054	27,605	1.72
1972	14,951	23,216	1.55	1992	15,846	28,475	1.80
1973	15,133	23,019	1.52	1993	15,340	28,653	1.87
1974	14,312	20,937	1.46	1994	15,611	28,648	1.84
1975	13,762	21,290	1.55	1995	17,546	31,208	1.78
1976	13,743	21,603	1.57				
1977	14,017	22,125	1.58				
1978	14,074	22,036	1.57				

On the one hand, when larger numbers of better educated persons become available, they are hired for the higher paying jobs first and those with less education are left unemployed longer and eventually take the lower paying jobs. Those with the

least education are unemployed longest and, where minimum wages are set by law above the value of marginal product, the least educated become permanently unemployable. On the other hand when smaller numbers of better educated persons are available, many with less education are employed in high paying jobs and the gap in average incomes gets smaller.

We will observe a major test of these two theories as we pass through periods of high and low enrollment in college during the next twenty years, and should emerge with a better basis for setting social policy on education in the twenty-first century.

APPENDIX

REPORT A1

Prediction of Mean Income, in 1977 Dollars, of Females 25 Years and Older, Who Had Income, 1967-77

High School Graduates

Coefficient of determination (R^2)	.82831
Adjusted R^2	.78538
Constant term	-12031.39
Standard error of estimate	69.51512

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
Labor force, in thousands, 29 years prior.	.3340391E-01	.00586	32.485	.83855
Average size of households, in hundreths, 13 years prior.	47.76423	24.68269	3.745	.28471

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	2	186503.91080	93251.95540
Deviation from Regression (Residual)	8	38658.81647	4832.35206

The significance level of the F ratio, which is 19.29743, lies between .001 and .0000.

Durbin-Watson d = 1.81258

REPORT A2

College Graduates

Coefficient of determination (R^2)	.87981
Adjusted R^2	.84976
Constant term	14674.01
Standard error of estimate	97.54554

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
High school graduates, in thousands, 26 years prior.	-3.499110	.45866	58.202	-1.04151
Gross national product per capita, in 1977 dollars, 45 years prior.	-.3801725	.13470	7.966	-.38531

Source of variation	Degrees of Freedom	Sum of squares	Mean squares
Attributable to regression	2	557199.12183	278599.56092
Deviation from regression (Residual)	8	76121.05999	9515.13250

The significance level of the F ratio, which is 29.27963, lies between .0005 and .0000.

Durbin-Watson d = 2.48938

REPORT A3

Prediction of Mean Income, in 1977 dollars, of
Male High School Graduates
29 Years Old, Who Had Income, 1956-77

Coefficient of determination (R^2)	.98659
Adjusted R^2	.98343
Constant term	-5940.605
Standard error of estimate	200.56751

Variables	Regression Coefficient (B)	Std. error of reg. coef.	Computed F value	Beta
Birth rate (live births per 10,000), 18 years prior.	65.20776	1.92745	1144.538	1.01853
Expenditures for higher education as a share of GNP, in tenths of per cents, 23 years prior.	-101.7307	30.75362	10.942	-.09969
Gross national product per capita, in 1977 dollars, 44 years prior.	.7466362	.18342	16.571	.12690
Gross national product per capita, in 1977 dollars, 38 years prior.	.6690977	.16923	15.632	.12352

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	4	50297500.54791	12574375.13698
Deviation from regression (Residual)	17	683864.54300	40227.32606

The significance level of the F ratio, which is 312.58292, lies between .0005 and .0000.

Durbin-Watson d = 2.44877

REPORT A4

Prediction of Mean Income, in 1977 dollars, of
Male College Graduates
29 Years Old, Who Had Income, 1956-77

Coefficient of determination (R^2)	.96282
Adjusted R^2	.95407
Constant term	10877.19
Standard error of estimate	321.11141

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
High school graduates, in thousands, 30 years prior.	5.958240	.32882	328.343	.90646
Expenditures for Higher education as a share of GNP, in tenths of per cents, 23 years prior.	-269.1538	49.25348	29.963	-.27426
Personal income, in hundreds of millions of 1977 dollars, 44 years prior.	.7046766	.19737	12.747	.17908
Labor force unemployed, in tenths of per cents, 47 years prior.	-8.140048	2.86180	8.090	-.14006

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	4	45396740.13496	11349185.03374
Deviation from regression (Residual)	17	1752913.18322	103112.54019

The significance level of the F ratio, which is 110.066, lies between .0005 and .0000.

Durbin-Watson d = 2.10507

REPORT A5

Prediction of Mean Income, in 1977 dollars, of Female
High School Graduates 29 Years Old, Who Had Income, 1967-77

Coefficient of determination (R^2)	.90625
Adjusted R^2	.88282
Constant term	4145.250
Standard error of estimate	82.03451

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
Bachelors plus first professional degrees earned by men.	.7178153E-02	.00082	76.248	.96393
High school graduates, in thousands, 26 years prior.	-.2427777	.35316	.473	-.07589

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	2	520450.89946	260225.44973
Deviation from regression (Residual)	8	53837.28236	6729.66030

The significance level of the F ratio, which is 38.66844, lies between .0005 and .0000.

Durbin-Watson d = 2.37742

REPORT A6

Prediction of Mean Income, in 1977 dollars, of Female
College Graduates 29 Years Old, Who Had Income, 1967-77

Coefficient of determination (R^2)	.89471
Adjusted R^2	.86839
Constant term	-20798.73
Standard error of estimate	113.14162

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
Personal income, in hundreds of millions of 1977 dollars, 27 years prior.	.4039433	.04901	67.937	.99453
Average size of households, in hundreths, 14 years prior.	82.18684	34.88416	5.531	.28427

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	2	870220.34508	435110.17254
Deviation from regression (Residual)	8	102408.20037	12801.02505

The significance level of the F ratio, which is 33.99026, lies between .0005 and .0000.

Durbin-Watson d = 2.25993

REPORT A7

Prediction of Mean Income, in 1977 dollars, of
Male High School Graduates
39 Years Old, Who Had Income, 1956-77

Coefficient of determination (R^2)	.97964
Adjusted R^2	.97485
Constant term	7195.229
Standard error or estimate	230.72226

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
High school graduates, in thousands, 31 years prior.	6.054517	.21965	759.790	1.00135
Gross national product, per capita, in 1977 dollars, 37 years prior.	.9572148	.18772	26.002	.20270
Expenditures for higher education as a share of GNP, in tenths of per cents, 23 years prior.	-112.8308	36.42398	9.596	-.11842
Labor force unemployed, in tenths of per cents, 46 years prior.	-1.885837	1.58710	1.412	-.04493

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	4	43535954.84730	10883988.71183
Deviation from regression(Residual)	17	904956.97088	53232.76299

The significance level of the F ratio, which is 204.46034, lies between .0005 and .0000.

Durbin-Watson d = 2.35760

REPORT A8

Prediction of Mean Income, in 1977 dollars, of
Male College Graduates
39 Years Old, Who had Income, 1956-77

Coefficient of determination (R^2)	.96623
Adjusted R^2	.95828
Constant term	-1590.450
Standard error of estimate	532.75542

Variables	Regression Coefficient (B)	Std. error of reg. coef.	Computed F value	Beta
Birth rate (live births per 10,000), 18 years prior.	103.2166	5.24535	387.213	.96308
Expenditures for higher education as a share of GNP, in tenths of per cents, 29 years prior.	283.7011	116.10859	5.970	.11372
Labor force unemployed, in tenths of per cents, 47 years prior.	-7.535072	4.79112	2.473	.07448
Labor force unemployed, in tenths of per cents, 43 years prior.	-1.608492	1.72755	.867	-.04433

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	4	138044921.03962	34511230.25991
Deviation from regression (Residual)	17	4825081.73311	283828.33724

The significance level of the F ratio, which is 121.59191, lies between .0005 and .0000.

Durbin-Watson d = 2.19008

REPORT A9

Prediction of Mean Income, in 1977 dollars,
of Female High School Graduates 39 Years Old,
Who Had Income, 1967-77

Coefficient of determination (R^2)	.85304
Adjusted R^2	.81630
Constant term	3489.593
Standard error of estimate	91.59379

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
Labor force, in thousands, 29 years prior.	.3555653E-01	.00842	17.844	.62674
Educational and general income of institutions of higher education, in millions of 1977 dollars, 27 years prior.	.1364420	.04309	10.025	.46976

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	2	389587.34464	194793.67232
Deviation from regression (Residual)	8	67115.38263	8389.42283

The significance level of the F ratio, which is 23.21896, lies between .0005 and .0000.

Durbin-Watson d = 2.22751

REPORT A10

Prediction of Mean Income, in 1977 dollars,
of Female College Graduates 39 Years Old,
Who Had Income, 1967-77

Coefficient of determination (R^2)	.92168
Adjusted R^2	.90211
Constant term	7337.770
Standard error of estimate	226.11703

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
Personal income, in hundreds of millions of 1977 dollars, 48 years prior.	2.185299	.24986	76.494	.86818
Personal disposable income, in hundreds of millions of 1977 dollars, 39 years prior.	-1.172948	.23971	23.944	-.48573

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	2	4813825.44131	2406912.72065
Deviation from regression (Residual)	8	409031.28597	51128.91075

The significance level of the F ratio, which is 47.07538, lies between .0005 and .0000.

Durbin-Watson d = 1.72341

REPORT All

Prediction of Mean Income, in 1977 dollars, of Male High School Graduates 49 Years Old, Who Had Income, 1956-77

Coefficient of determination (R^2)	.98572
Adjusted R^2	.98236
Constant term	-10729.86
Standard error of estimate	182.87468

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
High school graduates, in thousands, 31 years prior.	5.601199	.17977	970.768	.97874
Gross national product, per capita, in 1977 dollars, 37 years prior.	.9280549	.14170	42.893	.20763
Labor force unemployed, in tenths of per cents, 46 years prior.	-2.704297	1.25849	4.618	-.06806
Share of population, age 15 to 24 years old, in tenths of per cents, 37 years prior.	102.1789	101.43664	1.015	.03164

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	4	39244700.31966	9811175.07992
Deviation from regression(Residual)	17	568533.49852	33443.14697

The significance level of the F ratio, which is 293.36878, lies between .0005 and .0000.

Durbin-Watson d = 2.40733

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REPORT A12

Prediction of Mean Income, in 1977 dollars, of Male College Graduates 49 Years Old, Who Had Income, 1956-77

Coefficient of determination (R^2)	.97787
Adjusted R^2	.97267
Constant term	46378.07
Standard error of estimate	406.06699

Variables	Regression Coefficient (B)	Std. error of reg. coef.	Computed F value	Beta
Birth rate (live births per 10,000), 37 years prior.	-75.52830	2.86981	692.647	-1.02177
Gross national product, per capita, in 1977 dollars, 45 years prior.	-1.358630	.44125	9.481	-.13284
Expenditures for higher education as a share of GNP, in tenths of per cents, 27 years prior.	-181.5060	76.05918	5.695	-.09584
Personal income, in hundreds of millions of 1977 dollars, 40 years prior.	.4251009	.27541	2.383	.05976

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	4	123879488.68720	30969872.17180
Deviation from regression (Residual)	17	2803136.76735	164890.39808

The significance level of the F ratio, which is 187.82096, lies between .0005 and .0000.

Durbin-Watson d = 1.87633

REPORT A13

Prediction of Mean Income, in 1977 dollars, of Female High School Graduates 49 Years Old, Who Had Income, 1967-77

Coefficient of determination (R^2)	.91413
Adjusted R^2	.89266
Constant term	7148.325
Standard error of estimate	55.63721

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
High School graduates, in thousands, 31 years prior.	1.863918	.20919	79.393	.92416
Average size of households, in hundreths, 46 years prior.	-6.206634	2.20572	7.918	-.29185

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	2	263614.00776	131807.00388
Deviation from regression (Residual)	8	24763.99224	3095.49903

The significance level of the F ratio, which is 42.58021, lies between .0005 and .0000.

Durbin-Watson d = 2.39403

REPORT A14

Prediction of Mean Income, in 1977 dollars, of Female College Graduates 49 Years Old, Who Had Incomes, 1967-77

Coefficient of determination(R^2)	.46242
Adjusted R^2	.32803
Constant term	9757.764
Standard error of estimate	296.99516

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
Personal income, in hundreds of millions of 1977 dollars, 41 years prior.	.8108088	.34871	5.406	.60451
Educational and general income of institutions of higher education, in millions of 1977 dollars, 28 years prior.	-.1743550	.16876	1.067	-.26860

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	2	606991.91617	303495.95809
Deviation from regression (Residual)	8	705648.99292	88206.12411

The significance level of the F ratio, which is 3.44076, lies between .1000 and .0000.

Durbin-Watson d = 2.86762

REPORT A15

Prediction of Mean Income, in 1977 dollars, of Male
High School Graduates 59 Years Old, Who Had Income, 1956-77

Coefficient of determination (R^2)	.95515
Adjusted R^2	.94459
Constant term	23624.70
Standard error of estimate	283.52570

Variables	Regression Coefficient (B)	Std. error of reg. coef.	Computed F value	Beta
Birth rate (live births per 10,000), 37 years prior.	-35.01274	2.05759	289.557	-.96584
Gross national product, per capita, in 1977 dollars, 41 years prior.	-.4959911	.23766	4.356	-.11098
Gross national product, per capita, in 1977 dollars, 35 years prior.	-.1711072	.12760	1.798	-.07475
Labor force unemployed, in tenths of per cents, 47 years prior.	-2.052	2.49188	.679	-.04394

Source of variation	Degrees of freedom	Sum of squares	Mean Squares
Attributable to regression	4	29101742.82078	7275435.70519
Deviation from regression (Residual)	17	1366575.95195	80386.82070

The significance level of the F ratio, which is 90.50533, lies between the .0005 and .0000.

Durbin-Watson d = 1.99615

REPORT A16

Prediction of Mean Income, in 1977 dollars, of Male College Graduates 59 Years Old, Who Had Income, 1956-77

Coefficient of determination (R^2)	.88877
Adjusted R^2	.86260
Constant term	-34952.01
Standard error of estimate	965.45714

Variables	Regression Coefficient (B)	Std. error of reg. coef.	Computed F value	Beta
Share of population in urban households, in tenths of per cents, 39 years prior.	402.8370	9.48544	117.540	.90631
Labor force unemployed, in tenths of per cents, 47 years prior.	20.71794	8.33234	6.182	.20509
Personal disposable income, in hundreds of millions of 1977 dollars, 42 years prior.	1.154747	.52786	4.786	.17776
Labor force unemployed, in tenths of per cents, 45 years prior.	4.343769	4.11650	1.113	.08645

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	4	126611203.39858	31652800.84964
Deviation from regression (Residual)	17	15845827.37415	932107.49260

The significance level of the F ratio, which is 33.95832, lies between .0005 and .0000.

Durbin-Watson d = 2.10609

REPORT A17

Prediction of Mean Incomes, in 1977 dollars, of Female High School Graduates 59 Years Old, Who Had Income, 1967-77

Coefficient of determination (R^2)	.65586
Adjusted R^2	.56983
Constant term	4131.914
Standard error of estimate	147.00227

Variables	Regression Coefficient (B)	Std. error of reg. coef.	Computed F value	Beta
Personal disposable income, in hundreds of millions of 1977 dollars, 42 years prior.	.7052090	.19184	13.513	.77154
Personal income, in hundreds of millions of 1977 dollars, 44 years prior.	.1407157	.19076	.544	.15482

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	2	329472.84699	164736.42349
Deviation from regression (Residual)	8	172877.33483	21609.66685

The significance level of the F ratio, which is 7.62327, lies between .0250 and .0000.

Durbin-Watson d = 2.23538

REPORT A18

Prediction of Mean Incomes, in 1977 dollars, of Female College Graduates 59 Years Old, Who Had Income, 1967-77

Coefficient of determination (R^2)	.67966
Adjusted R^2	.59957
Constant term	11391.34
Standard error of estimate	423.85314

Variables	Regression Coefficient (B)	Std. error of reg. coef.	Computed F value	Beta
Personal disposable income, in hundreds of thousands of 1977 dollars, 38 years prior.	-1.518946	.41723	13.254	-.73290
Gross national product, per capita, in 1977 dollars, 47 years prior.	1.413725	.61061	5.361	.46610

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	2	3049295.77155	1524647.88577
Deviation from regression (Residual)	8	1437211.86481	179651.48310

The significance level of the F ratio, which is 8.48670, lies between .0250 and .0000.

Durbin-Watson d = 2.34887

REPORT A19

Prediction of Mean Incomes, in 1977 dollars, of Male High School Graduates 69 Years Old, Who Had Income, 1956-77

Coefficient of determination (R^2)	.74158
Adjusted R^2	.68078
Constant term	10619.32
Standard error of estimate	426.89858

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
High school graduates, in thousands, 43 years prior.	-2.898167	.45043	41.400	-.86159
Gross national product, per capita, in 1977 dollars, 46 years prior.	1.295350	.52436	6.103	.36079
Gross national product, per capita, in 1977 dollars, 44 years prior.	-1.046460	.36544	8.200	-.36677
Labor force unemployed, in tenths of per cents, 47 years prior.	-6.302468	4.03831	2.436	-.21506

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	4	8890702.39803	2222675.59951
Deviation from regression (Residual)	17	3098120.69288	182242.39370

The significance level of the F ratio, which is 12.19626, lies between .0010 and .0000.

Durbin-Watson d = 1.78825

REPORT A20

Prediction of Mean Incomes, in 1977 dollars, of Male College Graduates 69 Years Old, Who Had Income, 1956-77

Coefficient of determination (R^2)	.33444
Adjusted R^2	.22352
Constant term	13681.53
Standard error of estimate	1883.97726

Variables	Regression Coefficient (B)	Std. error of reg. coef.	Computed F value	Beta
Educational and general income of institutions of higher education, in millions of 1977 dollars, 43 years prior.	-2.433733	.89291	7.429	-.57943
Gross national product, per capita, in 1977 dollars, 46 years prior.	4.491646	2.14388	4.389	.44212
Gross national product, per capita, in 1977 dollars, 44 years prior.	-2.026106	1.58941	1.625	-.25096

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	3	32103991.38460	10701330.46153
Deviation from regression (Residual)	18	63888665.38813	3549370.29934

The significance level of the F ratio, which is 3.01499, lies between .1000 and .0000.

Durbin-Watson d = 1.82345

REPORT A21

Prediction of Mean Incomes, in 1977 dollars, of Female High School Graduates 69 Years Old, Who Had Income, 1967-77

Coefficient of determination(R^2)	.61392
Adjusted R^2	.51740
Constant term	3436.522
Standard error of estimate	194.11299

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
High school graduates, in thousands, 45 years prior.	1.588786	.46189	11.832	.76972
Labor force unemployed, in tenths of per cents, 48 years prior.	3.420363	2.16433	2.497	.35364

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	2	479323.70746	239661.85373
Deviation from regression (Residual)	8	301438.83799	37679.85475

The significance level of the F ratio, which is 6.36048, lies between .0250 and .0000.

The Durbin-Watson d = 1.73134

REPORT A22

Prediction of Mean Incomes, in 1977 dollars, of Female College Graduates 69 Years Old, Who Had Income, 1967-77

Coefficient of determination(R^2)	.42484
Adjusted R^2	.28105
Constant term	-3247.228
Standard error of estimate	561.41864

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
Professional workers, as a share of the labor force, in tenths of percents, 48 years prior.	42.63293	20.04416	4.524	.59108
Labor force unemployed, in tenths of percents, 47 years prior.	-3.566204	6.18509	.332	-.16023

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	2	1862543.45381	931271.72691
Deviation from regression (Residual)	8	2521527.09164	315190.88646

The significance of the F ratio, which is 2.95463, lies between .2500 and .0000.

The Durbin-Watson d = 1.66238

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